

Fisher® D3 FloPro Control Valve

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Figure 1. Fisher D3 FloPro Control Valve
NPS 2 RF Flanged End Connection



W9249

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for the Fisher D3 FloPro control valve and actuator.

Do not install, operate, or maintain D3 FloPro valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

Description

The D3 FloPro control valve (figure 1) is a compact, rugged valve designed for on-off control of a variety of fluids at pressures up to 155 bar (2250 psig). This valve is ideal for use as a dump valve on gas separators and scrubbers. It is also well suited for other high pressure applications in natural gas production, compression, and processing. NPS 1 and NPS 2 D3 FloPro control valves are available in CL900 NPT end connections and CL600 raised face flanged end connections.



Table 1. Specifications

Valve Body Sizes and End Connection Styles⁽¹⁾

See table 3

Maximum Inlet Pressures and Temperatures⁽¹⁾

VALVE BODY SIZE	MAXIMUM INLET PRESSURE	TEMPERATURE RANGE
	bar (psig)	°C (°F)
NPS 1 and NPS 2 NPT CL900	155 (2250)	-46 to 93 (-50 to 200)
	150 (2185)	93 to 149 (200 to 300)
NPS 1 and NPS 2 RF CL600	103 (1500)	-46 to 93 (-50 to 200)
	100 (1455)	93 to 149 (200 to 300)

Maximum Shutoff Pressure Drops⁽¹⁾

See table 2

Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4

Class IV

Flow Characteristic / Valve Plug Style

Equal percentage / Micro-Form Valve Plug

Port Diameters

See table 3

Maximum Travel

15 mm (0.6 inch)

Material Temperature Capabilities⁽¹⁾**Valve Body Assembly:***Standard O-Ring:* -40 to 135°C (-40 to 275°F)**Actuator Assembly:** -34 to 82°C (-30 to 180°F)**Flow Direction**

Flow Up or Flow Down

Available Actuator Configurations

Spring-to-Open

Spring-to-Close

Maximum Actuator Casing Pressure⁽¹⁾

3.4 bar (50 psig)

Actuator Diaphragm Effective Area329 cm² (51 square inches)**Actuator Pressure Connections**

1/4 NPT internal

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

Specifications

Table 1 lists specifications for the D3 FloPro control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the upper diaphragm casing.

Table 2. Fisher D3 Maximum Shutoff Pressure Drops

FLOW DIRECTION	ACTUATOR ACTION	INPUT SIGNAL	NUMBER OF SPRINGS	MAXIMUM ΔP (PSI) PER PORT SIZE (INCH)		
		psi		0.375	0.75	1.00
Up	Spring-to-Close	0-20	3	2250	544	341
		0-35	6	2250	1504	999
	Spring-to-Open	0-20	2	2250	935	608
		0-35	2	2250	2250	2094
Down	Spring-to-Close	0-20	2	1558	1800	950
		0-35	3	2250	2250	2250
	Spring-to-Open	0-20	2	2250	1700	939
		0-35	3	2250	2250	1575

Table 3. Valve Sizes and Connection Styles

VALVE SIZE, NPS	PORT DIAMETER, (INCHES)	THREADED	RAISED FACE (RF) FLANGED
		CL900	CL600
1	0.375, 0.75, 1	X	X
2	0.375, 0.75, 1	X	X

X = Available construction.

Educational Services

For information on available courses for Fisher D3 valves, as well as a variety of other products, contact:

Emerson Process Management
 Educational Services - Registration
 P.O. Box 190
 Marshalltown, IA 50158-2823
 Phone: 800-338-8158 or 641-754-3771
 FAX: 641-754-3431
 e-mail: education@emerson.com

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in table 1. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

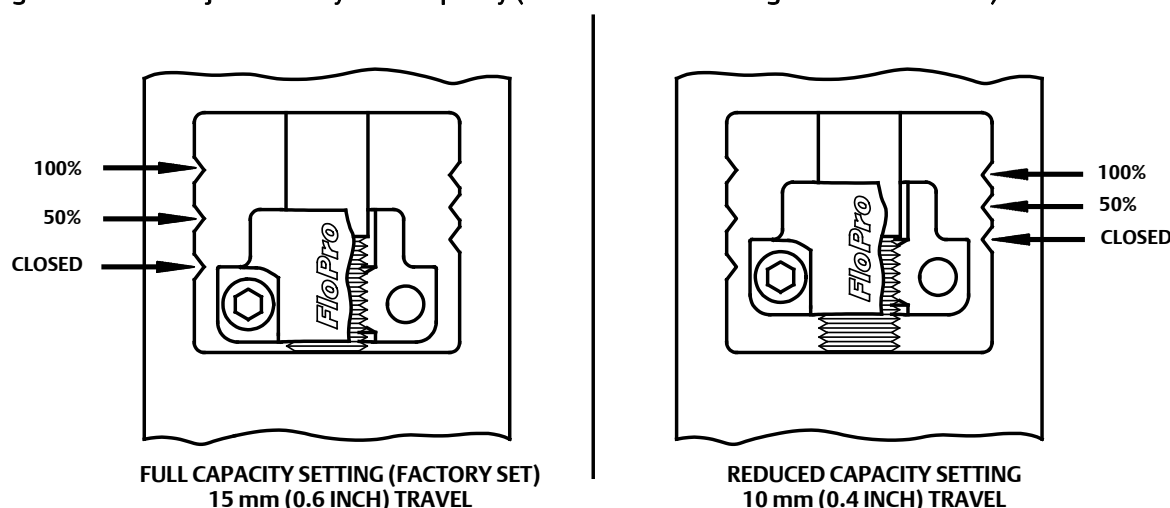
When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson Process Management sales office.

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials.

3. The control valve assembly may be installed in any orientation, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged connections, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. Connect loading pressure for the Spring-to-Close configuration to the lower casing assembly (key 21) as shown in figure 7. The Spring-to-Open configuration loading pressure connection is in the upper casing assembly (key 32) as shown in figure 8.

Figure 2. FloPro Adjusts to Vary Flow Capacity (Shown with Valve Plug in Seated Position)



Setting the Valve FloPro Flow Adjuster

The flow setting may only be adjusted if the 0.375 and 0.75 inch port sizes are installed.

When shipped from the factory, the actuator has the FloPro flow adjuster set at the maximum flow rate position for the given port size.

Spring-to-Close Actuator Action

1. Ensure the valve plug is in the seated position.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 15), and reposition the flow adjuster halves (key 13 and 14) to the desired flow rate position. See figure 2 for flow rate settings.
3. Retighten the socket head screws (key 15) to 3 N•m (26 lbf•in).

Spring-to-Open Actuator Action

1. Attach a pressure line to the actuator. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to seat the plug in the seat ring.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 15), and reposition the flow adjuster halves (key 13 and 14) to the desired flow rate position. See figure 2 for flow rate settings.

3. Retighten the socket head screws (key 15) to 3 N•m (26 lbf•in).

Maintenance

Refer to figures 7 and 8.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Plug and Seat Ring Maintenance

Trim Disassembly

Spring-to-Close (Air-to-Open)

Key numbers are referenced in figure 7.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

CAUTION

The following steps are intended to prevent damage to the valve plug (key 3) and seat ring (key 2) during the removal of the bonnet and actuator.

2. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve to mid travel. This will raise the valve plug (key 3) off its seat and expose all of the serrations on the valve stem (key 16).
3. Loosen the hex socket head cap screws (key 15) and lower the flow adjuster (keys 13 and 14) to its lowest position on the valve stem.

4. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).
5. Relieve pressure to the actuator, shut off all pressure lines to the actuator, and disconnect. Use lockout procedures to ensure the above measures stay in effect while you work on the equipment.
6. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

7. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
8. Remove the valve plug by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed. Do not remove the Belleville springs (key 9) from the stem, in order to retain the Belleville stacking orientation as shown in figure 3.
9. Use a 1-3/16 inch socket wrench to loosen and remove the seat ring (key 2).

CAUTION

Inspect the seat ring and valve body interior for wear, erosion, or damage in the following steps.

10. Inspect the seat ring for wear or damage. If the seating surface has been damaged, discard the seat ring.
11. Visually inspect the valve body interior below the seat ring for erosion or damage. Replace the valve body if necessary.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

Spring-to-Open (Air-to-Close)

Key numbers are referenced in figure 8.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

Note

The following steps are intended to ensure the groove pin is fully exposed below the bonnet to allow you to remove the pin before removing the valve plug.

2. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve fully closed. This will seat the valve plug (key 3) and expose the top of the serrations on the valve stem (key 16).

3. Loosen the hex socket head cap screws (key 15) and raise the flow adjustor (keys 13 and 14) to its highest position on the valve stem.
4. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).
5. Relieve pressure to the actuator and disconnect the air lines. Ensure the flow adjustor is touching the top of the bonnet window. Use lockout procedures to ensure the above measures stay in effect while you work on the equipment.
6. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

7. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
8. Remove the valve plug by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed. Do not remove the Belleville springs (key 9) from the stem, in order to retain the Belleville stacking orientation as shown in figure 3.
9. Use a 1-3/16 inch socket wrench to loosen and remove the seat ring (key 2).

CAUTION

Inspect the seat ring and valve body interior for wear, erosion, or damage in the following steps.

10. Inspect the seat ring for wear or damage. If the seating surface has been damaged, discard the seat ring.
11. Visually inspect the valve body interior below the seat ring for erosion or damage. Replace the valve body if necessary.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

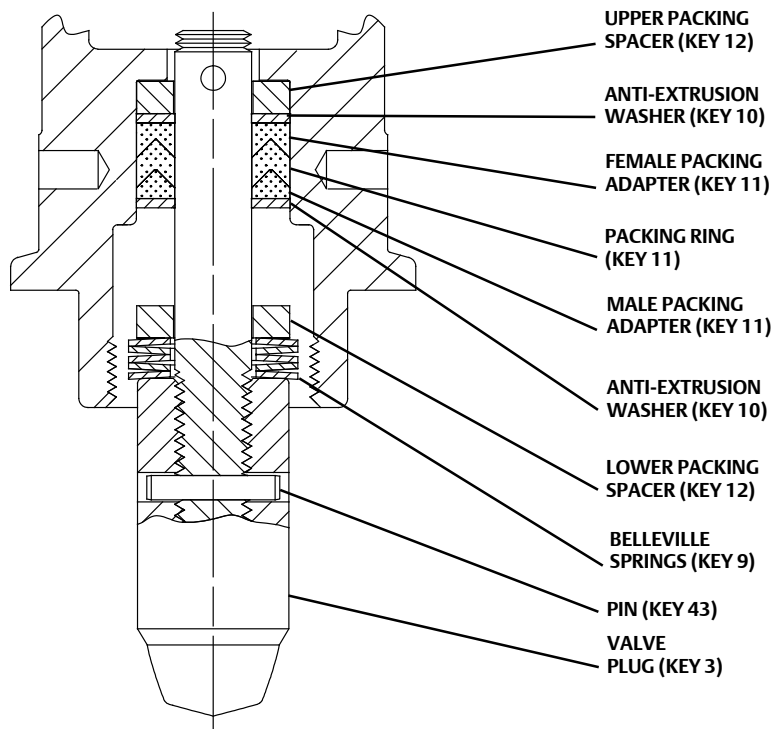
Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

Trim Assembly

Spring-to-Close (Air-to-Open)

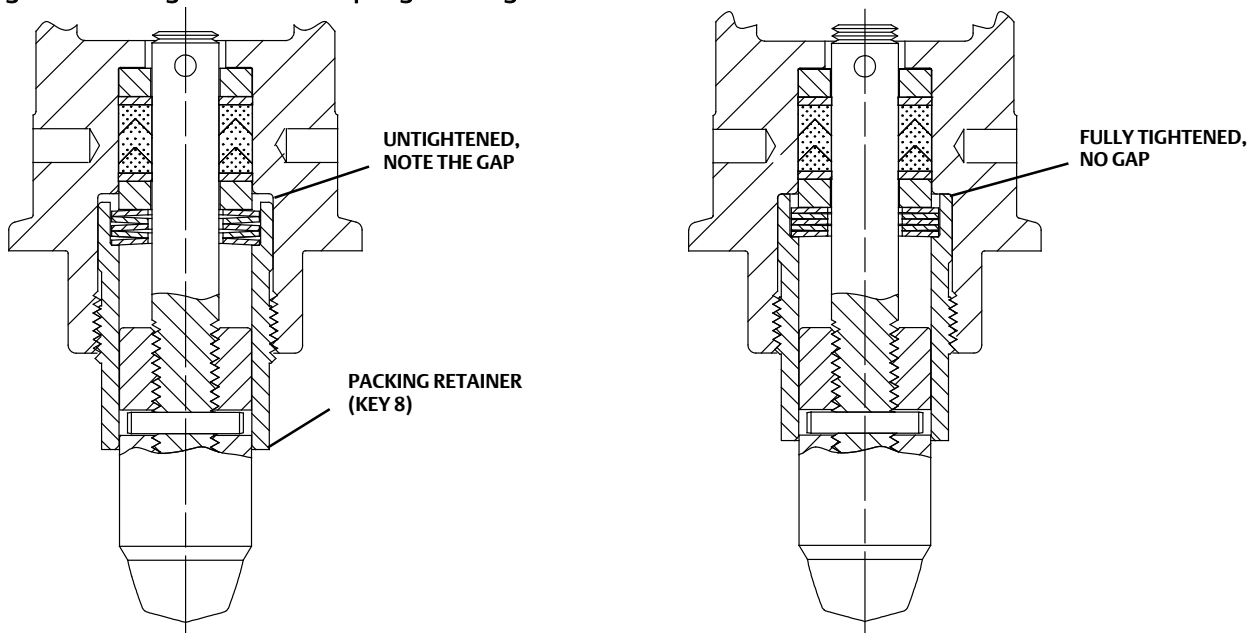
1. Ensure the threads of the valve stem (key 16) and valve plug (key 3) are clean and free of debris.
2. Make sure the Belleville springs (key 9) are properly installed on the valve stem, as shown in figure 3.
3. Install the valve plug on the stem and insert a new pin (key 43).
4. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
5. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.

Figure 3. Packing and Belleville Spring Stacking Order



VALVE PLUG INSTALLED WITHOUT PACKING RETAINER

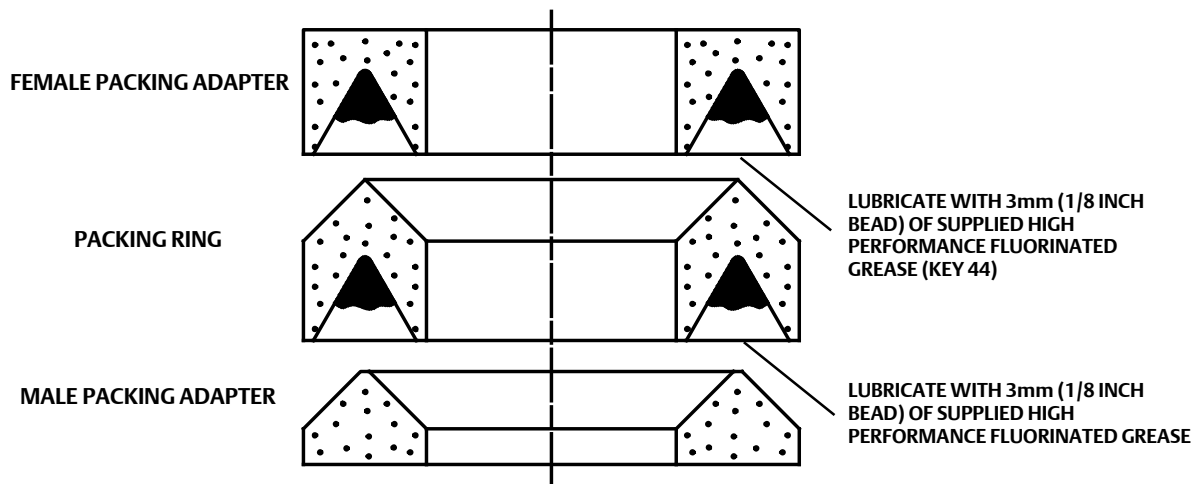
Figure 4. Packing and Belleville Spring Stacking Order



BELLEVILLE SPRINGS FULLY ENCLOSED BY THE PACKING RETAINER

VALVE PLUG, BELLEVILLE SPRINGS, AND PACKING RETAINER CORRECTLY INSTALLED AND TIGHTENED

Figure 5. Lubrication Locations on Packing



6. Thoroughly clean the seat ring (key 2) threads and the mating threads in the valve body (key 1).
7. Apply anti-seize lubricant to the threads of the seat ring and its mating threads in the valve body.
8. Screw the seat ring into the valve body. Use a 1-3/16 inch socket wrench to tighten the seat ring to 170 N•m (125 lbf•ft). Remove all excess lubricant after tightening.
9. Lubricate the bonnet O-ring (key 4) with lithium grease and install on the bonnet.
10. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.
11. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve to mid travel.
12. Loosen the hex socket head cap screws (key 15) and remove the flow adjuster (keys 13 and 14).
13. Relieve pressure to the actuator to fully close the valve.
14. Make sure the valve is fully seated and install the flow adjuster (keys 13 and 14) and hex socket head cap screws (key 15).
15. Set the desired flow rate position according to figure 2.
16. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).

Spring-to-Open (Air-to-Close)

1. Ensure the threads of the valve stem (key 16) and valve plug (key 3) are clean and free of debris.
2. Make sure the Belleville springs (key 9) are properly installed on the valve stem, as shown in figure 3.
3. Install the valve plug on the stem and insert a new pin (key 43).
4. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
5. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal to metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
6. Thoroughly clean the seat ring (key 2) threads and the mating threads in the valve body (key 1).
7. Apply anti-seize lubricant to the threads of the seat ring and its mating threads in the valve body.
8. Screw the seat ring into the valve body. Use a 1-3/16 inch socket wrench to tighten the seat ring to 170 N•m (125 lbf•ft). Remove all excess lubricant after tightening.

9. Lubricate the bonnet O-ring (key 4) with lithium grease and install on the bonnet.
10. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.
11. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve fully closed.
12. Loosen the hex socket head cap screws (key 15) and set the desired flow rate position according to figure 2.
13. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).
14. Relieve pressure to the actuator.

Packing Maintenance

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Key numbers are referenced in figure 3.

The valve stem packing can only be serviced by removing the bonnet from the valve body.

Packing Disassembly

Spring-to-Close (Air-to-Open)

1. Disassemble the valve per steps 1 - 8 in the Spring-to-Close Trim Disassembly section of the Valve Plug and Seat Ring Maintenance section of this manual.
2. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet (key 7) using a formed wire hook.
3. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged and cannot be improved by light sanding, replace the bonnet.
4. Inspect the valve stem (key 16) and valve plug (key 3) for scratches or wear and replace if necessary.

Spring-to-Open (Air-to-Close)

1. Disassemble the valve per steps 1 - 8 in the Spring-to-Open Trim Disassembly section of the Valve Plug and Seat Ring Maintenance section of this manual.
2. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet (key 7) using a formed wire hook.
3. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged and cannot be improved by light sanding, replace the bonnet.
4. Inspect the valve stem (key 16) and valve plug (key 3) for scratches or wear and replace if necessary.

Packing Assembly

The following steps define the proper procedure for installing the packing in a D3 FloPro Control Valve. Improper packing assembly can lead to poor valve performance. The proper packing arrangement is shown in figure 3.

Spring-to-Close (Air-to-Open)

1. Ensure the upper packing spacer (key 12) is installed.

2. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
3. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.
6. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
7. Firmly press all packing parts into the packing bore with a tube.
8. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
9. Install the valve plug (key 3) on the stem and insert a new groove pin (key 43).
10. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in figure 4.
11. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
12. Assemble the valve per steps 9 - 16 in the Spring-to-Close Trim Assembly section of the Valve Plug and Seat Ring Maintenance section of this manual.

Spring-to-Open (Air-to-Close)

1. Ensure the upper packing spacer (key 12) is installed.
2. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
3. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.
6. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
7. Firmly press all packing parts into the packing bore with a tube.
8. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
9. Install the valve plug (key 3) on the stem and insert a new groove pin (key 43).
10. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in figure 4.
11. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
12. Assemble the valve per steps 9 - 14 in the Spring-to-Open Trim Assembly section of the Valve Plug and Seat Ring Maintenance section of this manual.

Servicing the Actuator

The D3 FloPro valve is equipped with a spring and diaphragm actuator. The actuator action may be reversed without the need for additional parts. The number of springs contained in the actuator may have to be adjusted according to actuator action and/or supply pressure. Refer to table 2 for the proper number of springs for your actuator action and valve service conditions.

Actuator Disassembly

Spring-to-Close (Air-to-Open)

Key numbers are referenced in figure 7.

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Inspect all parts for wear or damage during disassembly. Replace any worn or damaged parts with genuine Fisher replacement parts. If the diaphragm is replaced, a new diaphragm O-ring should also be installed.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

⚠ WARNING

To prevent possible personal injury or property damage from removing the casing cap screws in the wrong sequence, follow the procedure as outlined below for removing the upper casing.

Be aware as you loosen and remove the actuator casing cap screws that the actuator springs are under compression.

2. Remove the ten **short** actuator casing cap screws (key 29).
3. Remove the two **long** actuator casing cap screws (key 31) by alternating between them as you loosen them. Keep the upper casing (key 32) level during this procedure.
4. Remove the upper casing and the springs (key 28).
5. Remove the stem nut (key 27) taking care not turn the valve stem (key 16). Keep the valve stem from turning by inserting a 1/8 inch drift punch in the holes provided on the valve stem.
6. Remove the actuator spacer (key 26), diaphragm O-ring (key 19), diaphragm plate (key 24), diaphragm (key 23), and the diaphragm washer (key 22).
7. Remove the bonnet locknut (key 20) with a 1-1/2 inch socket wrench and lift off the lower casing (key 21).
8. Remove the casing O-ring (key 17).
9. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

10. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
11. Remove the valve plug (key 3) by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed.
12. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet using a formed wire hook.
13. Completely remove the flow adjuster (keys 13, 14, and 15) from the valve stem.
14. Remove the valve stem from the top of the bonnet.

CAUTION

The valve stem must be removed to replace the stem O-ring and the bonnet bushing. If the valve stem is removed, the valve packing must be replaced since the threads on the valve stem may damage the packing when the valve stem is removed.

15. Remove the stem O-ring (key 25) and the bonnet bushing (key 18).
16. If the hammer nut needs to be removed from the bonnet, the spring pins (or pipe plugs) (key 6, figures 7 or 8) can be removed with locking pliers.

Spring-to-Open (Air-to-Close)

Key numbers are referenced in figure 8.

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Inspect all parts for wear or damage during disassembly. Replace any worn or damaged parts with genuine Fisher replacement parts. If the diaphragm is replaced, a new diaphragm O-ring should also be installed.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.
2. Remove the ten **short** actuator casing cap screws (key 29) and the two **long** actuator casing cap screws (key 31).
3. Remove the upper casing (key 32).
4. Lubricate the threads above the stem nut (key 27) with anti-seize lubricant to prevent galling of the threads.

WARNING

To prevent possible personal injury or property damage, be aware as you loosen and remove the stem nut that the actuator springs are under compression.

5. Relieve spring tension by slowly removing the stem nut. Do not allow the valve stem (key 16) to turn while removing the stem nut. Keep the valve stem from turning by inserting a 1/8 inch drift punch in the holes provided on the valve stem.
6. Remove the diaphragm washer (key 22), diaphragm (key 23), diaphragm plate (key 24), diaphragm O-ring (key 19), and actuator spacer (key 26).
7. Remove the bonnet locknut (key 20) with a 1-1/2 inch socket wrench and lift off the lower casing (key 21).
8. Remove the casing O-ring (key 17).
9. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

WARNING

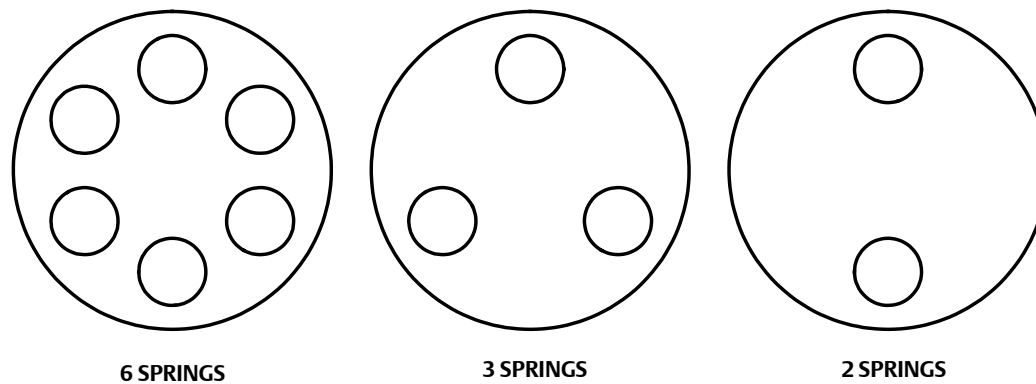
The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

10. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
11. Remove the valve plug (key 3) by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed.
12. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet using a formed wire hook.
13. Completely remove the flow adjuster (keys 13, 14, and 15) from the valve stem.
14. Remove the valve stem from the bottom of the bonnet (key 16).

CAUTION

The valve stem must be removed to replace the stem O-ring and the bonnet bushing. If the valve stem is removed, the valve packing must be replaced since the threads on the valve stem may damage the packing when the valve stem is removed.

Figure 6. Spring Locations As Seen From Above Lower Actuator Casing



15. Remove the stem O-ring (key 25) and the bonnet bushing (key 18).
16. If the hammer nut needs to be removed from the bonnet, the spring pins (or pipe plugs) (key 6, figures 7 or 8) can be removed with locking pliers.

Actuator Assembly

Spring-to-Close (Air-to-Open)

Key numbers are referenced in figure 7. The proper packing arrangement is shown in figure 3.

CAUTION

Avoid possible product damage in the following procedure by ensuring there are no burrs or sharp edges on any threads or surfaces which may damage internal valve components during assembly.

Make sure all parts are clean and in good condition before starting assembly. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage soft parts in the valve assembly.

CAUTION

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

1. Install the bonnet nut (key 5) and spring pins (or pipe plugs) (key 6, figures 7 or 8) if previously removed.

2. Lubricate the stem O-ring (key 25) with lithium grease and install in the bonnet (key 7).
3. Press the bonnet bushing (key 18) with the slots upward into the upper hole in the bonnet. The bonnet bushing is installed correctly when it snaps into place.
4. Install the casing O-ring (key 17) in the provided groove at the top of the bonnet.
5. Position the lower casing (key 21) on the bonnet.
6. Install the casing locknut (key 20) on the bonnet and torque to 203 N•m (150 lbf•ft).
7. Install the valve stem (key 16) from the bottom of the bonnet. Inserting the valve stem in this manner will prevent damage to the bonnet bushing and stem O-ring.
8. Ensure the upper packing spacer (key 12) is installed.
9. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
10. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

11. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
12. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.
13. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
14. Firmly press all packing parts into the packing bore with a tube.
15. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
16. Install the valve plug on the stem and insert a new pin (key 43).
17. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
18. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet. The packing retainer threads should be completely enclosed by the bonnet.
19. Lubricate the bonnet O-ring (key 4) with lithium grease and install onto the bonnet.
20. Ensure the seat ring is installed in the valve body.
21. Apply anti-seize lubricant on the threads of the valve body (key 1), the threads of the bonnet nut (key 5), and the contact surfaces of the bonnet and bonnet nut flange.
22. Install the bonnet and actuator assembly into the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

CAUTION

Avoid possible product damage which may affect proper operation of the diaphragm. Ensure the washer is aligned with the hole in the diaphragm so the washer does not cut the diaphragm.

23. Install the diaphragm washer (key 22) over the valve stem threads with the lip facing upward. If you are unsure of the correct orientation for the diaphragm washer, see figure 7 view A for the correct orientation.
24. Install the diaphragm (key 23), diaphragm plate (key 24), diaphragm O-ring (key 19), and actuator spacer (key 26) on the valve stem. Position the diaphragm so the holes in the diaphragm align with the holes in the lower casing.
25. Lubricate the threads above the stem nut (key 27) with anti-seize lubricant to prevent galling of the threads.
26. Install the stem nut (key 27) and torque to 20 N•m (15 lbf•ft). Use a 1/8 inch drift punch to keep the valve stem from turning as the hex nut is installed.

CAUTION

Non-symmetrical spring arrangement could cause actuator failure, resulting in possible product damage.

27. Install the correct number of springs (key 28) in a symmetrical pattern on the spring locators on the diaphragm plate. See figure 6 for the proper arrangement of the springs. The correct number of springs is dependent on your application and supply pressure. See table 2 for the correct number of springs.
28. Place the upper casing (key 32) on the diaphragm and lower casing. Position the upper casing so the holes in the upper casing align with the holes in the diaphragm and lower casing.

CAUTION

Do not lubricate cap screws (key 29 and 31). The following torque specifications are for unlubricated bolting.

29. Install the two **long** cap screws (key 31) opposite each other. Install the hex nuts (key 30) onto the long cap screws and tighten, alternating until the upper casing contacts the diaphragm. Keep the upper casing level during this process.
30. Install the ten **short** cap screws (key 29) into the remaining holes and install hex nuts on the remaining cap screws.
31. Torque the hex nuts in a crossing pattern to 16 N•m (12 lbf•ft).
32. Make sure valve is fully seated and install the flow adjustor (keys 13 and 14) and hex socket head cap screws (key 15).
33. Set the desired flow rate position according to figure 2.
34. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).

Spring-to-Open (Air-to-Close)

Key numbers are referenced in figure 8. The proper packing arrangement is shown in figure 3.

CAUTION

Avoid possible product damage in the following procedure by ensuring there are no burrs or sharp edges on any threads or surfaces which may damage internal valve components during assembly.

Make sure all parts are clean and in good condition before starting assembly. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage soft parts in the valve assembly.

CAUTION

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

1. Install the bonnet nut (key 5) and spring pins (or pipe plugs) (key 6, figures 7 or 8) if previously removed.
2. Lubricate the stem O-ring (key 25) with lithium grease and install in the bonnet (key 7).
3. Press the bonnet bushing (key 18) with the slots upward into the upper hole in the bonnet. The bonnet bushing is installed correctly when it snaps into place.
4. Install the casing O-ring (key 17) in the provided groove at the top of the bonnet.
5. Position the lower casing (key 21) on the bonnet.
6. Install the casing locknut (key 20) on the bonnet and torque to 203 N•m (150 lbf•ft).
7. Install the valve stem (key 16) from the bottom of the bonnet. Inserting the valve stem in this manner will prevent damage to the bonnet bushing and stem O-ring.
8. Ensure the upper packing spacer (key 12) is installed.
9. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
10. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

11. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
12. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.

13. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
14. Firmly press all packing parts into the packing bore with a tube.
15. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
16. Install the valve plug on the stem and insert a new pin (key 43).
17. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
18. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet. The packing retainer threads should be completely enclosed by the bonnet.
19. Lubricate the bonnet O-ring (key 4) with lithium grease and install onto the bonnet.
20. Ensure the seat ring is installed in the valve body.
21. Apply anti-seize lubricant on the threads of the valve body (key 1), the threads of the bonnet nut (key 5), and the contact surfaces of the bonnet and bonnet nut flange.
22. Install the bonnet and actuator assembly into the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

CAUTION

Non-symmetrical spring arrangement could cause actuator failure, resulting in possible product damage.

23. Install the correct number of springs (key 28) in a symmetrical pattern on the lower casing. See figure 6 for the proper arrangement of the springs. The correct number of springs is dependent on your application and supply pressure. See table 2 for the correct number of springs.
24. Install the actuator spacer (key 26), diaphragm O-ring (key 19), diaphragm plate (key 24), and diaphragm (key 23) on the valve stem. Position the diaphragm so the holes in the diaphragm align with the holes in the bottom casing.

CAUTION

Avoid possible product damage which may affect proper operation of the diaphragm. Ensure the washer is aligned with the hole in the diaphragm so the washer does not cut the diaphragm.

25. Install the diaphragm washer (key 22) over the valve stem threads with the lip facing downward. If you are unsure of the correct orientation for the diaphragm washer, see figure 8 view A for the correct orientation. Make sure the lip fits inside the diaphragm hole.
26. Lubricate the threads above the stem nut (key 27) with anti-seize lubricant to prevent galling of the threads.
27. Install the stem nut and torque to 20 N•m (15 lbf•ft). Use a 1/8 inch drift punch to keep the valve stem from turning as the hex nut is installed. The springs will be compressed when the stem nut is fully tightened.
28. Place the upper casing (key 32) on the diaphragm and lower casing. Position the upper casing so the holes in the upper casing align with the holes in the diaphragm and lower casing.

CAUTION

Do not lubricate cap screws (key 29 and 31). The following torque specifications are for unlubricated bolting.

29. Install the two **long** cap screws (key 31) opposite each other. Install the ten **short** cap screws (key 29) into the remaining holes and install hex nuts (key 30) on all cap screws.
30. Torque the hex nuts in a crossing pattern to 16 N•m (12 lbf•ft).
31. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve fully closed.
32. Make sure valve is fully seated and install the flow adjustor (keys 13 and 14) and hex socket head cap screws (key 15).
33. Set the desired flow rate position according to figure 2.
34. Tighten the hex head screws to 3 N•m (26 lbf•in).
35. Relieve pressure to the actuator.

Changing Actuator Action

From Spring-to-Close to Spring-to-Open

1. Follow steps 1 to 6 in the Disassembly instructions for the Spring-to-Close actuator on page 12 of this manual.
2. Follow steps 23 to 34 in the Assembly instructions for the Spring-to-Open actuator on page 17 of this manual.

From Spring-to-Open to Spring-to-Close

1. Follow steps 1 to 6 in the Disassembly instructions for the Spring-to-Open actuator on page 13 of this manual.
2. Follow steps 23 to 34 in the Assembly instructions for the Spring-to-Close actuator on page 17 of this manual.

Parts Ordering

Each D3 FloPro control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your Emerson Process Management representative for assistance or when ordering replacement parts.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 7. Fisher D3 FloPro Valve Assembly (Spring-to-Close)

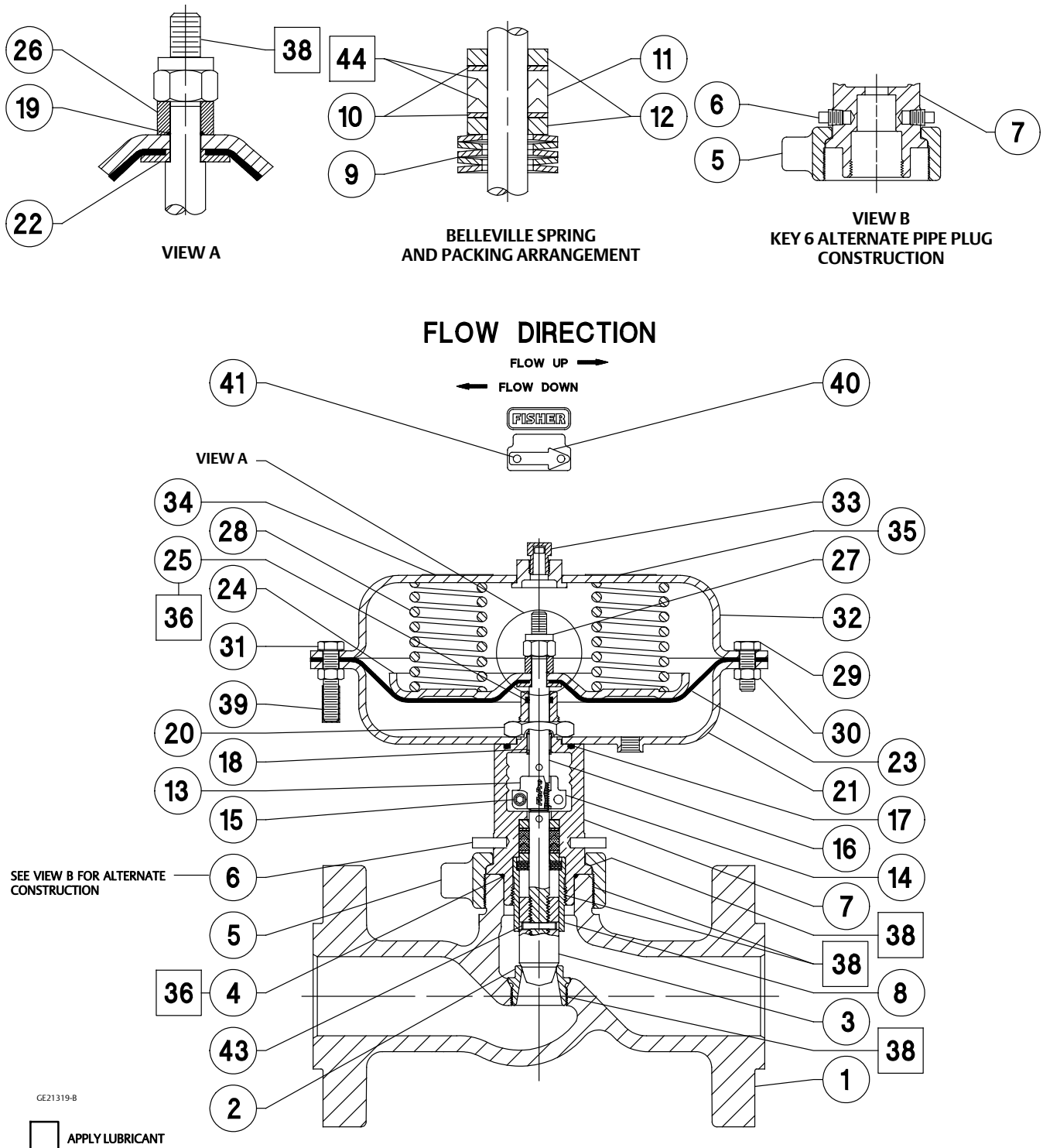
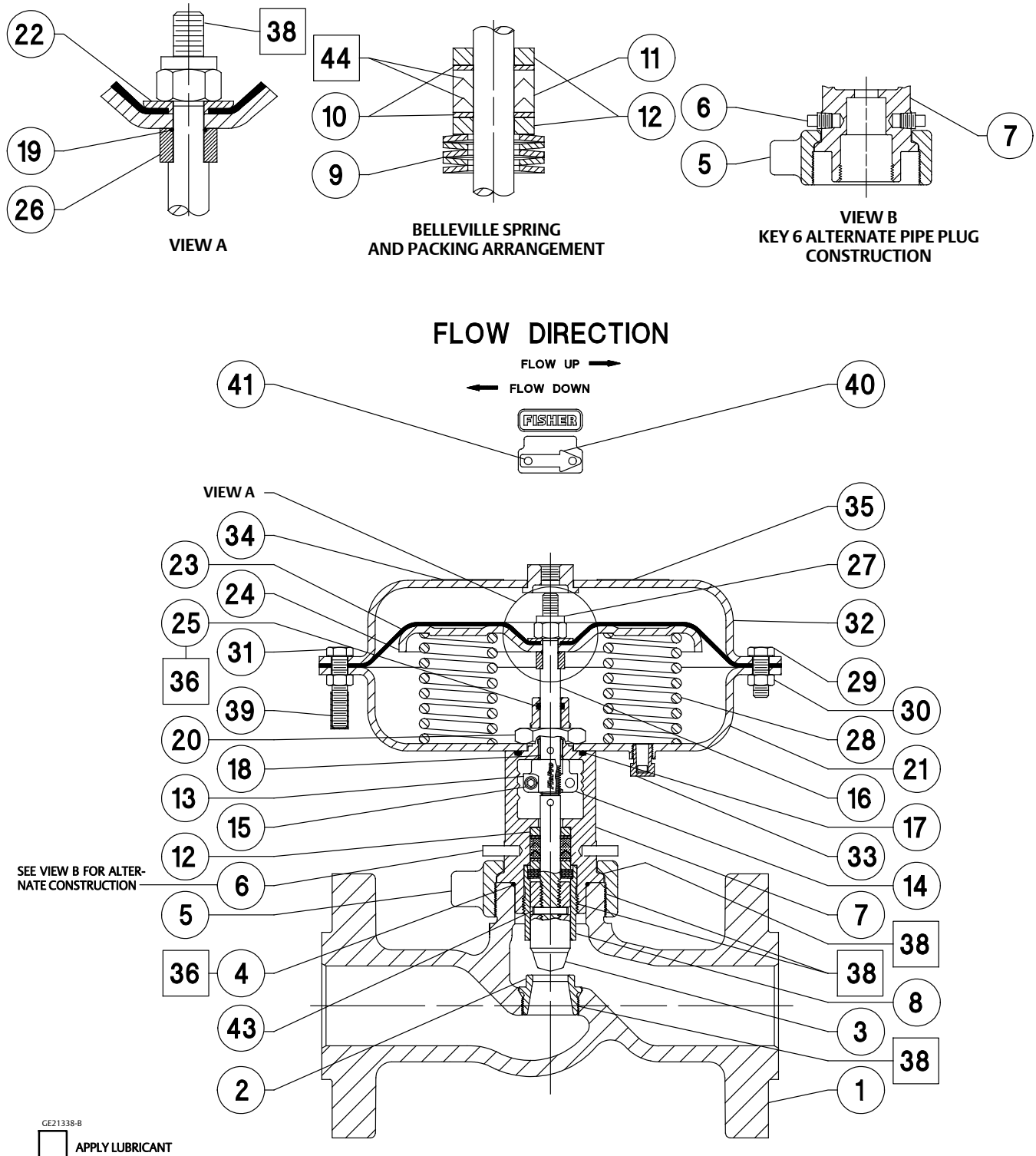


Figure 8. Fisher D3 FloPro Valve Assembly (Spring-to-Open)



Parts Kits

TRIM KITS	Port Diameter (inches)	0.375	0.75	1
	Standard trim kit (Contains keys 2, 3, 4, and 43)	RD3STD0012	RD3STD0022	RD3STD0032
	Carbide trim kit (Contains keys 2, 3, 4, and 43)	RD3CARBX042	RD3CARBX052	RD3CARBX062
ACTUATOR KIT	Contains keys 17, 18, 19, 23, and 25		RD3X0000012	
PACKING KIT	Contains keys 4, 10, 11, 43, and 44		RD3PACKX012	
SPRING	Key 28		GE18774X012	
BONNET O-RING	Key 4		1P1676X0062	
VALVE STEM	Key 16		GE20615X012	

Parts List

Note

Recommended spare parts are included in the Parts Kits shown at the top of this page. For additional information or for part numbers not shown, contact your Emerson Process Management sales office.

Key Description

1	Valve Body
2*	Seat Ring
3*	Valve Plug
4*	Bonnet O-ring
5	Bonnet Nut
6	Spring Pin (or alternate pipe plug) (2 req'd)
7	Bonnet
8	Packing Retainer
9	Belleville Springs (5 req'd)
10*	Anti-Extrusion Washer (2 req'd)
11*	Packing Set
12	Packing Spacer
13	FloPro Half
14	FloPro Half
15	Hex Socket Head Cap Screw (2 req'd)

Key Description

16*	Stem
17*	Casing O-ring
18*	Bonnet Bushing
19*	Diaphragm O-ring
20	Locknut
21	Lower Casing
22	Diaphragm Washer
23*	Diaphragm
24	Diaphragm Plate
25*	Stem O-ring
26	Actuator Spacer
27	Stem Nut
28*	Spring (quantity varies with application)
29	Short Hex Head Cap Screw (10 req'd)
30	Hex Nut (12 req'd)
31	Long Hex Head Cap Screw (2 req'd)
32	Upper Casing
33	Vent
34	Nameplate
35	Spring Label
36	Lubricant, lithium grease
38	Lubricant, Anti-Seize
39	Protector Cap (2 req'd)
40	Flow Arrow
41	Drive Screw (2 req'd)
43*	Groove Pin
44*	High Performance Fluorinated Grease Packing Lubricant

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